REMARKS

Claims 1-5, 9-13, 19, and 24-25 and 41-45 stand rejected. Claims 6-8, 14-18, 20-23, and 26-40 are objected to. Claims 6-8, 20, 26, 34 and 46 are amended hereby. Support for these amendments can be found throughout the originally filed specification as described in more detail below. Upon entry of this amendment, claims 1-46 remain pending.

Claims 6-8, 20, and 26 have been amended merely to place these otherwise allowable claims in independent form. No substantive changes were made to the claims with these amendments.

Support for the amendment to claim 34 can be found throughout the originally filed specification. The amendment to claim 34 is non-substantive as it is merely a minor formatting change.

Support for the amendment to claim 46 is implicit throughout the originally filed specification, including originally filed claim 46. As recognized by the Examiner in paragraph 8 of the current Office Action, it is inherent that the computer program recited in originally filed claim 46 is embodied within a computer readable medium. When asserting a different rejection in paragraph 8 of the current Office Action, the Examiner states "there is no disclosure discussing the computer readable storage medium the computer program is embodied on." Further, on page 38, lines 9-11, of the originally filed specification, Applicant describes how methods of the invention "can be efficiently implemented in hardware such as "digital signal processors." Storage of bits generated during implementation of the invention is described on page 21, lines 28-30, and page 22, lines 15-18, of the originally filed specification. It is inherent that a computer program executable on a computing device would be embodied within a computer readable medium as known to those of ordinary skill in the relevant art.

The Claim Objection

Claim 34 stands objected to. The Examiner states that it is "unclear which sub-act d the claim is referring to: step D in claim 34 or act d in claim 24." It is respectfully submitted that the language of claim 34 is clear as set forth. Withdrawal of this objection is respectfully requested.

Claim 34 recites a method "wherein . . . feedback sub-act (e)(ii) comprises the following sub-acts: . . . B) proceeding to a sub-act C) if the feedback bit indicates an even channel, else proceeding to a sub-act d); C) updating a base vector based on an even weight, and proceeding to sub-act E); D) updating the base vector based on an odd weight; and E) computing new values . . . ." Claim 34 depends from claim 25, which depends from claim 24. Claim 25 does not specifically reference "act d" or "sub-act d." The only other reference to any act-related "d" is in claim 24, but that is in relation to an "act d" (as opposed to sub-act d). Thus, the only "sub-act d" referenced in claims 24-25 and 34 is set forth in claim 34 itself. As such, the language of claim 34 is clear in that reference to "sub-act d" therein refers to sub-act d subsequently recited in claim 34 itself. Thus, withdrawal of this objection is respectfully requested.

Despite the clarity of the claim without amendment, Applicant hereby amends claim 34 to consistently use uppercase letters when referring to all sub-acts therein. In Applicant's previous Amendment filed on July 7, 2006, claim 34 was amended at Applicant's own initiative to convert outline reference numbers for the sub-acts therein from lowercase to uppercase letters. The present amendment similarly converts the formatting of sub-act d referenced therein so that it matches the formatting of outline reference numbers for the remaining sub-acts.

The 35 U.S.C. §101 Rejection

Claim 46 stands rejected under 35 U.S.C. §101 as allegedly being directed toward non-statutory subject matter. This rejection is respectfully traversed. Withdrawal thereof is requested.

Claim 46 is amended herewith. As presently amended, claim 46 recites: "A computer-readable medium comprising a computer program executable on a computing device, wherein the program is capable of generating weighted transmit signals with nulling in a communication system.

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. . ." In setting forth this rejection, the Examiner states that as recited in claim 46 the "computer program is not embodied on a computer readable storage medium. When function [*sic*] descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized." Thus, claim 46 is hereby amended to recite that the "computer program executable on a computing device" is embodied within a "computer-readable medium."

In view of the amendment of claim 46 as suggested by the Examiner, withdrawal of this rejection is respectfully requested.

The 35 U.S.C. §112, First Paragraph, Rejection

Claim 46 stands rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the written description requirement thereof. This rejection is respectfully traversed. Withdrawal thereof is requested.

In setting forth this rejection, the Examiner asserts that the claimed subject matter was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor had possession of the claimed invention. Applicant respectfully disagrees.

Originally filed claim 46 reads as follows:

A computer program executable on a general purpose computing device, wherein the program is capable of generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the transmitter includes a plurality of antennae, comprising:

a)   a first set of instructions for initializing a parameter set and a weight vector;

b)   a second set of instructions for updating the weight vector based on an inverse cost function;

c)   a third set of instructions for updating the parameter set; and

d)   a fourth set of instructions for returning to the act (b).

Rejected claim 46 reads as follows:

A computer program executable on a computing device, wherein the program is capable of generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the

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transmitter includes a plurality of antennae, comprising:

a) a first set of instructions for initializing a parameter set and a weight vector;

b) a second set of instructions for updating the weight vector based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases;

c) a third set of instructions for updating the parameter set; and

d) a fourth set of instructions for returning to the act (b).

Thus, the only differences between rejected claim 46 and originally filed claim 46 are deletion of the phrase "general purpose" before "computing device" and insertion of details of the "inverse cost function" recited in b). The subject matter of claim 46 is, therefore, supported by the originally filed specification, which includes originally filed claim 46. As described in Manual of Patent Examining Procedure (MPEP) §2163, "There is a strong presumption that an adequate written description of the claimed invention is present when the application is filed. *In re Wertheim*, 541 F.2d 257, 263, 191 USPQ 90, 97 (CCPA 1976)." It is clear from comparing the language of originally filed claim 46 and that of claim 46 as rejected by the Examiner that Applicant had possession of the invention recited in rejected claim 46 as of the filing date of the present application. As such, withdrawal of this rejection is requested.

In addition, Applicant notes that claim 46 is hereby amended to recite that the "computer program executable on a computing device" is embodied within a "computer-readable medium." Amended claim 46 also satisfies the written description requirement of 35 U.S.C. §112, first paragraph. As recognized by the Examiner in paragraph 8 of the current Office Action, it is inherent that the computer program recited in originally filed claim 46 is embodied within a computer readable medium. Further, it is implicit and well within the knowledge of those skilled in the relevant art that a computer program executable on a computing device must be embodied within a computer-readable medium. If not, the computer program would not be executable on a computing device. Embodying such a computer program within a computer readable medium is also well within the knowledge of those skilled in the relevant art and no further disclosure is necessary to satisfy the written description requirement.

On a related note, Applicant refers to Manual of Patent Examining Procedure (MPEP) §2163, which references *Fonar Corp. v. General Electric Co.*, 107 F.3d 1543, 1549, 41 USPQ2d 1801, 1805 (Fed. Cir. 1997): "As a general rule, where software constitutes part of a best mode of carrying out an invention, description of such a best mode is <u>satisfied by a disclosure of the functions</u> of the software. This is because, normally, writing code for such software is within the skill of the art, not requiring undue experimentation, once its functions have been disclosed. . . . Thus, <u>flow charts or source code listings are not a requirement for adequately disclosing the functions of software</u>" (emphasis added). In the present case, the function of the computer program is recited in claim 46 (*i.e.*, "the program is capable of generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the transmitter includes a plurality of antennae, comprising" four sets of instructions). Again, the written description requirement is satisfied, as implementation of a computer program having the recited function within a computer-readable medium is well within the skill of the relevant art.

The 35 U.S.C. §102(b) Rejection

Claims 1-5, 9-13, 19, 24-25, and 41-45 stand rejected under 35 U.S.C. §102(b) as allegedly being anticipated by Raleigh et al. (U.S. Patent No. 6,144,711). This rejection is respectfully traversed. Withdrawal thereof is requested.

As an initial matter, for the reasons stated herein, Applicant respectfully submits that Raleigh does not qualify as prior art under 35 U.S.C. §102(b). 35 U.S.C. §102(b) applies when "the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States." Applicant respectfully submits that such is not the case with respect to Raleigh et al. and the presently claimed invention.

Raleigh et al. issued on November 7, 2000, with a priority date of August 29, 1996. The present application was filed on February 22, 2002, with an earliest priority date of August 2, 2000 and a further priority date of March 23, 2001 (based upon a provisional application filed on that

date). Therefore, as the earliest effective filing date of the present application precedes issuance of Raleigh et al. and the further priority date of the present application is less than one year prior to the date Raleigh et al. issued, Raleigh et al. is not citable under 35 U.S.C. §102(b) against the present patent application. This rejection must therefore be withdrawn for this reason alone and withdrawal thereof is respectfully requested.

Even if Raleigh is deemed to qualify as prior art, Applicant respectfully submits that Raleigh et al does not teach or suggest each and every element of the claimed invention. Raleigh et al. is directed toward a space-time signal processing system using a substantially orthogonalizing procedure (SOP). As described in column 2, the SOP decomposes the time domain space-time communication channel that may have intersymbol interference (ISI) into a set of parallel, space-frequency, SOP bins wherein the ISI is substantially reduced and the signal received at a receiver in one bin of the SOP is substantially independent of the signal received in any other bin of the SOP. Thus, two or more substantially independent communication channels may be provided, even in the presence of significant cross talk interference between two or more physical transmit and receive antenna pairs.

The presently claimed invention is differentiated from Raleigh et al. For example, claim 1 recites:

> A method of generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a plurality of receivers, and wherein the transmitter includes a plurality of antennae, the method comprising:
>
> a)   initializing a parameter set and a weight vector set;
>
> b)   updating the weight vector set based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases;
>
> c)   updating the parameter set; and
>
> d)   returning to the act (b).

Claims 2-5, 9-13, and 19 depend, directly or indirectly, from claim 1. Raleigh et al. do not teach or suggest each and every element of claims 1-5, 9-13, and 19. Although transmitter spatial vector weights within each SOP bin may increase the power delivered to the desired receiver within

one or more spatial subchannels while reducing interference radiated to unintended receivers as indicated by the Examiner on page 5 of the current Office Action, Raleigh et al. do not teach or suggest methods of the invention comprising updating a weight vector set "based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases." As described on page 17 of Applicant's Amendment filed on July 7, 2006, the inverse cost function does not reflect only the power delivered to the "proper" (*i.e.*, target) receiver, but also reflects power delivered to the "improper" (*i.e.*, non-target) receivers.

Further, Raleigh et al. do not teach or suggest the inverse cost function equation as recited in presently pending claim 5. In addition, although Raleigh et al. refers to "multiple access system bursts" in column 36, lines 1-16, Raleigh et al. do not teach teach or suggest DS-CDMA communication systems as recited in presently pending claim 4.

Claim 24 recites:

A method of generating vector weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a plurality of receivers, and wherein the transmitter includes a plurality of antennae, the method comprising:

a) initializing a weight vector for each receiver;

b) initializing a set of adaptation parameters;

c) generating a transmit probing signal for each particular receiver based on the weight vector and parameter set for the particular receiver and on channel estimates for each of a plurality of tracked receivers comprising a subset of the receivers of the system;

d) generating feedback based on reception of the corresponding transmit probing signal generated in act (c) for each receiver within the subset of tracked receivers;

e) updating the weight vector employed by the transmitter for each particular receiver based on the feedback generated in act (d) for each receiver; and

f) updating the parameter set by the transmitter based on the weight vector updated in act (e).

Claim 25 directly depends from claim 24. Although transmitter spatial vector weights within each SOP bin may increase the power delivered to the desired receiver within one or more spatial

subchannels while reducing interference radiated to unintended receivers as indicated by the Examiner on page 5 of the current Office Action, Raleigh et al. do not teach or suggest methods of the invention comprising steps of "generating a transmit probing signal for each particular receiver based on the weight vector and parameter set for the particular receiver and on channel estimates for each of a plurality of tracked receivers," "generating feedback based on reception of the corresponding transmit probing signal," "updating the weight vector employed by the transmitter for each particular receiver based on the feedback generated," and "updating the parameter set by the transmitter based on the weight vector updated."

> Claim 41 recites:
>
> A method of generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the transmitter includes a plurality of antennae, the method comprising:
>
> a)   initializing a plurality of baseband transmit weight vectors and a plurality of channel estimate vectors for multiple tracked transmissions;
>
> b)   updating the plurality of baseband transmit weight vectors based on a metric of a cross interference and a plurality of channel estimates;
>
> c)   updating the plurality of channel estimates based on the plurality of baseband transmit weight vectors; and
>
> d)   returning to act (b).

Although transmitter spatial vector weights within each SOP bin may increase the power delivered to the desired receiver within one or more spatial subchannels while reducing interference radiated to unintended receivers, thereby changing the undesired receiver interference and the channel estimates, as indicated by the Examiner on pages 6-7 of the current Office Action, Raleigh et al. do not teach or suggest methods of the invention comprising steps of "updating the plurality of baseband transmit weight vectors based on a metric of a cross interference and a plurality of channel estimates" and "updating the plurality of channel estimates based on the plurality of baseband transmit weight vectors." As described on pages 18-19 of Applicant's Amendment filed July 2, 2006, cross interference, like an inverse cost function, entails consideration of the impact of a

transmission on different receivers. It is the explicit consideration of interference to other receivers (cross interference) that enables some embodiments of the claimed invention to provide "nulling" of interference to receivers other than the target receiver.

Claim 42 recites:

A communication system, capable of generating weighted transmit signals with nulling, comprising:

a)   a transmitter, capable of initializing a parameter set and a weight vector associated with the transmitter and updating the weight vector based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases, and updating the weight vector means, and generating even and odd probing signals, for updating the parameter set; and

b)   a receiver, capable of providing feedback regarding even and odd channel strength.

Although transmitter spatial vector weights within each SOP bin increase the power delivered to the desired receiver within one or more spatial subchannels while reducing interference radiated to unintended receivers, as indicated by the Examiner on page 7 of the current Office Action, Raleigh et al. do not teach or suggest updating a weight vector set "based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases." As described on page 17 of Applicant's Amendment filed on July 7, 2006, the inverse cost function does not reflect only the power delivered to the "proper" (*i.e.*, target) receiver, but also reflects power delivered to the "improper" (*i.e.*, non-target) receivers.

Claim 43 recites:

A transmitter, capable of generating weighted transmit signals with nulling, comprising:

a)   an initializer, adapted to initialize a parameter set and a weight vector associated with the transmitter;

b)   a first update device, responsive to the initializer, adapted to update the weight vector based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated

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as delivered to non-target receivers increases; and

c)   a second update device, responsive to the updating the weight vector means, adapted to update the parameter set.

Although transmitter spatial vector weights within each SOP bin increase the power delivered to the desired receiver within one or more spatial subchannels while reducing interference radiated to unintended receivers, as indicated by the Examiner on page 5 of the current Office Action, Raleigh et al. do not teach or suggest updating a weight vector set "based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases." As described on page 17 of Applicant's Amendment filed on July 7, 2006, the inverse cost function does not reflect only the power delivered to the "proper" (*i.e.*, target) receiver, but also reflects power delivered to the "improper" (*i.e.*, non-target) receivers.

Claim 44 recites:

An apparatus for generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the transmitter includes a plurality of antennae, comprising:

a)   means for initializing a parameter set and a weight vector associated with the transmitter;

b)   means, responsive to the initialization means, for updating the weight vector based on an inverse cost function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases; and

c)   means, responsive to the updating the weight vector means, for updating the parameter set.

Although transmitter spatial vector weights within each SOP bin increase the power delivered to the desired receiver within one or more spatial subchannels while reducing interference radiated to unintended receivers, as indicated by the Examiner on page 5 of the current Office Action, Raleigh et al. do not teach or suggest updating a weight vector set "based on an inverse cost

function, a value of which increases when power calculated as delivered to a target receiver increases and decreases when power calculated as delivered to non-target receivers increases." As described on page 17 of Applicant's Amendment filed on July 7, 2006, the inverse cost function does not reflect only the power delivered to the "proper" (*i.e.*, target) receiver, but also reflects power delivered to the "improper" (*i.e.*, non-target) receivers.

> Claim 45 recites:
>
> An apparatus for generating weighted transmit signals with nulling in a communication system, wherein the communication system includes a transmitter and a receiver, and wherein the transmitter includes a plurality of antennae, comprising:
>
> a)   means for initializing a plurality of baseband transmit weight vectors and a plurality of channel estimate vectors for multiple tracked transmissions;
>
> b)   means, responsive to the initialization means, for updating the plurality of baseband transmit weight vectors based on a metric of a cross interference and a plurality of channel estimates; and
>
> c)   means, responsive to the updating the weight vector means, for updating the plurality of channel estimates based on the plurality of baseband transmit weight vectors.

Although transmitter spatial vector weights within each SOP bin may increase the power delivered to the desired receiver within one or more spatial subchannels while reducing interference radiated to unintended receivers, thereby changing the undesired receiver interference and the channel estimates, as indicated by the Examiner on pages 6-7 of the current Office Action, Raleigh et al. do not teach or suggest apparatus of the invention comprising "means, responsive to the initialization means, for updating the plurality of baseband transmit weight vectors based on a metric of a cross interference and a plurality of channel estimates" and "means, responsive to the updating the weight vector means, for updating the plurality of channel estimates based on the plurality of baseband transmit weight vectors." As described on pages 18-19 of Applicant's Amendment filed July 2, 2006, cross interference, like an inverse cost function, entails consideration of the impact of a transmission on different receivers. It is the explicit consideration of interference to other receivers (cross interference) that enables some embodiments of the claimed invention to provide "nulling" of interference to receivers other than the target receiver.

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Allowable Subject Matter

Claims 6-8, 14-18, 20-23, and 26-40 stand objected to as being dependent upon a rejected base claim. However, these claims were indicated to be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims. Claims 6-8, 20, and 26 have been rewritten in independent form as suggested. Claims 21-23 depend, directly or indirectly, from claim 20. Claims 27-33 depend, directly or indirectly, from claim 26. Thus, prompt notice of allowance of claims 6-8, 20-23, and 26-33 is hereby respectfully requested based on these non-substantive amendments.

Prior Art Made of Record, But Not Relied Upon

It is believed that the other document made of record but not relied upon (*i.e.*, U.S. Patent No. 6,888,809 to Foschini et al.) is no more relevant to patentability of the presently claimed invention than those documents described herein. The differences between Foschini et al. and the present claims are not addressed in this paper based on their significance and due to the fact that Foschini et al. has not been relied upon in rejecting any of the pending claims as being unpatentable. Applicants reserve the right, however, to provide detailed arguments in that regard should Foschini et al. be relied upon as supporting a position that the claims are unpatentable in the future.

Conclusion

It is respectfully submitted that the amendment and remarks set forth above overcome each objection and ground of rejection set forth by the Examiner. As such, the Examiner is respectfully requested to reconsider the application, to withdraw all objections and rejections, and, barring the discovery of new grounds for rejection, to promptly issue a Notice of Allowance of all pending claims.

The Commissioner is authorized to construe this paper as including a petition to extend the period for response by the number of months necessary to make this paper timely filed. Fees or deficiencies required to cause the response to be complete and timely filed may be charged, and any overpayments should be credited, to our Deposit Account No. **50-0490**.

Respectfully submitted,

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